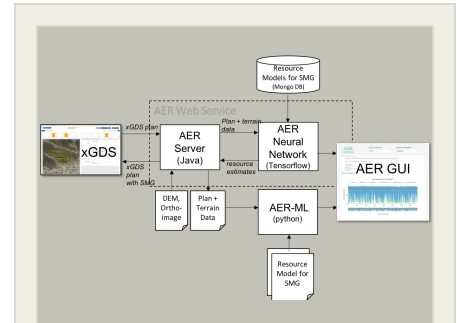# Adaptive Resource Estimation and Visualization for Planning Robotic Missions, Phase II

Completed Technology Project (2016 - 2018)

Project Introduction

NASA's future human exploration missions will include remotely operated rovers performing surface exploration and science, as well as free-flyers to reduce the need for human Extra Vehicular Activity. Technologies are needed for remote operation and supervised autonomy of robots. Consider the Resource Prospector (RP) lunar mission. For RP it will be necessary to accomplish as much as possible in the available time. A key requirement for planning such operations is the ability to accurately predict how much resource (e.g., time, power) is needed to perform planned tasks. More accurate resource estimates can prevent wasting resources trying to complete unrealistic plans. Quick turnaround of plans revisions can minimize the time the robot is idle while its plan is being modified. TRACLabs and CMU propose to develop software for the Adaptive Estimation of Resources (AER) to help build and revise plans for robots performing NASA missions. This software will be used to estimate the duration of planned tasks using information about terrain features combined with historical plan performance. These estimates can be used to assess the feasibility of robot plans when built. And can be used to assess the impact of changes to robot plans during execution. These resource models will be updated during a mission to improve the accuracy of estimates at a site. Providing more accurate resource estimates for building robot plans produces plans more likely to complete within the allocated resources. These estimates give the planner a better sense of what resources are required to achieve objectives, which affects both the selection of which objectives to pursue and the order in which to purse them. When replanning is needed, either due to unexpected opportunities or problems, these estimates can help the team determine whether sufficient time remains to complete the revised plan and, if not, help users perform plan trades to determine which subset of activities should be attempted.

Adaptive Resource Estimation and Visualization for Planning Robotic Missions, Phase II
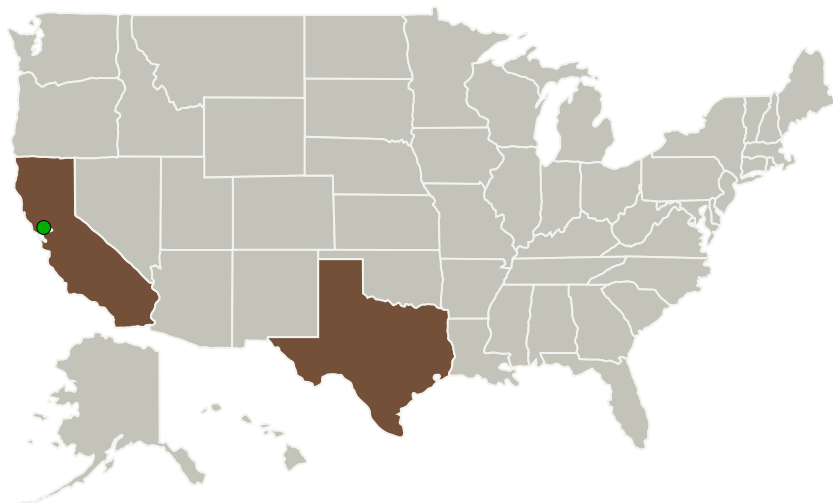
Table of Contents

Adaptive Resource Estimation and Visualization for Planning Robotic Missions, Phase II

Completed Technology Project (2016 - 2018)

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
TRACLabs, Inc.	Lead Organization	Industry	Webster, Texas
🟢 Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Carnegie Mellon University	Supporting Organization	Academia	Pittsburgh, Pennsylvania
Carnegie Mellon University - Silicon Valley	Supporting Organization	Academia	Moffett Field, California

Primary U.S. Work Locations	
California	Texas

Project Transitions

▶ **September 2016:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TRACLabs, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

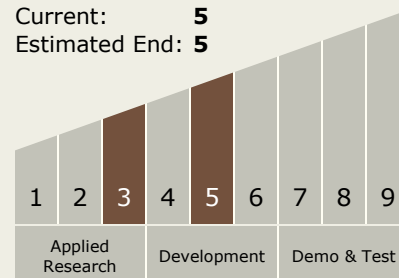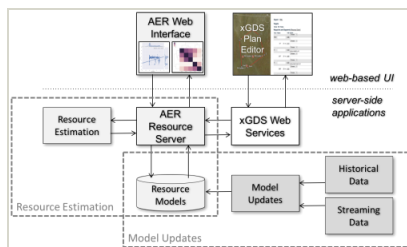Carlos Torrez

Principal Investigator:

Debra L Schreckenghost

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**

✔ **September 2018:** Closed out

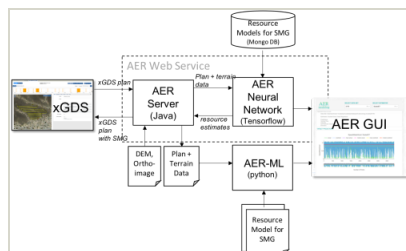**Closeout Documentation:**
- Final Summary Chart*(https://techport.nasa.gov/file/140803)*

Images

Briefing Chart Image
Adaptive Resource Estimation and Visualization for Planning Robotic Missions, Phase II
(https://techport.nasa.gov/image/126428)

Final Summary Chart Image
Adaptive Resource Estimation and Visualization for Planning Robotic Missions, Phase II
(https://techport.nasa.gov/image/132455)

Technology Areas

Primary:

- TX04 Robotic Systems
  └ TX04.4 Human-Robot Interaction
    └ TX04.4.1 Multi-Modal and Proximate Interaction

Target Destinations
The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System